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ABSTRACT

To predict the educational quality of programs in 150 school districts, this study used 34 predictor variables in a multiple regression analysis. Dependent variables used to represent educational quality in a district were (1) the percent of rejections by the local Selective Service Boards for mental reasons, (2) the percent of elementary and secondary dropouts, (3) the mean scores on various portions of the American College Test, (4) the percent of graduates that enrolled in college, and (5) a holding power index. Included in the predictor variables used were (1) seven measures of the nature and socioeconomic status of the community, (2) six measures of the instructional program, (3) ten measures of the nature of the school staff, (4) four measures of the structure of the school district, and (5) seven measures of noninstructional expenditures. The authors summarize the results of each regression and present a general summary of their findings. The implications of the study and some recommendations for those school districts desiring to improve educational quality conclude the presentation. (DN)

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THE PREDICTION OF QUALITY EDUCATION IN MISSISSIPPI PUBLIC SCHOOLS

by

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Introduction

What constitutes a quality education program in a public school district? Obviously, opinions vary widely. Many people hold that "quality" of education is a global factor, made up largely or entirely of intangible factors that are difficult or impossible to measure.

Many others, however, hold that major components of "quality" can be measured, and the literature is full of studies which relate various factors to such measures as per pupil expenditures, class size, preparation of teachers, etc. In recent years, though, there has been a recognition that education is a "system" with inputs, processes, and outputs.

When viewed in this way, variables can be identified and quantified in each of these categories. "Input" variables are those which are brought to the teaching-learning situation. "Process" variables are, obviously, those which are part of the teaching-learning situation. "Output" variables are those which measure characteristics of students following the teaching-learning situation.

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When viewed in this way, many people feel that the "quality" of a school program must be closely related to "outputs"; that is, a "good" school system is one which produces a large amount of whatever is considered important. Under this notion, how this comes about is of lesser importance than what is produced, although the variables that affect the "how" are of interest in making changes in the degree of the "what."

Since most school districts do not have well-defined objectives, it is difficult to determine what the outputs are or should be, and, for a state as a whole, this remains to a large extent a matter of opinion.

For the purposes of this study, it was decided that the "quality" of a public school district should be expressed in terms of one or more measures of output. This only partially solves the problem of definition, for it leaves unanswered the question of which measure or measures of output are quality. Neither the literature nor education opinion supports any one output variable or small number of output variables as quality.

Accordingly, it was determined that "quality" would be expressed in several ways, such that the reader could take his choice of any one or any combination of these ways as the determiner of quality of the educational output of the 150 public school districts of Mississippi.

Measures of Quality Used in this Study

From an extensive review of the literature, qualified by the data which were available for most or all school districts in the

state for the 1970-1971 school year, the following measures of output were identified and used in this study:

(1) percent of rejections by the local Selective Service Boards for mental reasons;

(2) percent of elementary dropouts;

(3) percent of secondary dropouts;

(4) mean composite score on the American College Test (ACT);

(5) mean score on the English portion of the ACT;

(6) mean score on the mathematics portionof the ACT;

(7) mean score on the social studies portion of the ACT;

(8) mean score on the natural sciences portion of the ACT;

(9) percent of graduates that enrolled in college; and

(10) holding power index.

Rankings of the 150 Districts on the Output Variables

After the data were collected for the 150 school districts on each of the ten variables listed above, the data for each variable were converted into standard scores and ranked.[1] Because these data are expressed in standard scores, the reader may combine them in any way he chooses to obtain an index of quality of educational outputs. One such composite ranking, based on a combination of all ten factors, was computed and presented in the study. Based on this ranking, the "top ten" school districts in Mississippi are, respectively, Long Beach, Clinton, Hattiesburg, Pascagoula, Tupelo, Holly Springs, Biloxi, Columbus, Starkville, and New Albany.

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[1]These sets of rankings are available from either author.

Predictor Variables

Through the use of a multiple regression technique, thirty-four "input" and "process" variables were examined to see which ones served as predictors of each of the ten measures of "output" (quality) used in the study, and in what combinations. The thirty-four variables were selected because they were commonly used in studies of quality education and because data for them were available throughout the state. The variables included seven measures of the nature and socio-economic status of the community, six measures of the instructional program, ten measures of the nature of the staff of the school, four measures of the structure of the school district, and seven measures of non-instructional expenditures.

As expected, some variables were better predictors of quality than others; in fact, many turned out to be quite inconsequential. In some cases, none of the variables were good predictors of the measure of quality under consideration.[1] In all cases, multiple predictors were found that were better than any single predictor.

Predictors of the Output Measures of Quality

Rejections by the Selective Service for mental reasons. The University of Mississippi's computer was programmed to generate an equation for each of the measures of quality, such as the following for the percent of rejections by the local Selective Service Boards for mental reasons:

$$Y' = .42854 - .02807\ X_1 + .59879\ X_2 + .00720\ X_3 + .01138\ X_4 - .00003\ X_5 \quad (R^2 = .698),$$

[1]Among the variables that were not statistically significant in any of the predictions were: per pupil expenditures for fixed costs and administration; assessments per pupil; superintendent's annual salary; and whether or not the superintendent held a doctorate.

Where the variables are, respectively, median grade attainment of adults in the community, percent of population non-white, average years of experience of teachers, maintenance of plant per pupil, and median family income. The R^2 value means that 69.8% of the variance has been accounted for among the variables used, the remainder being due to unidentified variables that were not among the 34 used in this study.

The findings indicated that, among the 34 variables used in the study, the percent of rejections by the local Selective Service Boards for mental reasons could be predicted by (in order of importance) percent of population non-white,* median grade attainment of adults in the community (negative),** average years experience of teachers, median family income (negative), and expenditure per pupil for maintenance of plant.

In other words, other factors being equal, the higher the median grade attainment and median family income, the lower the predicted percent of rejections. Unexpectedly, it was found that, other things being equal, the higher the average years of experience of teachers, the higher the predicted percent of rejections on the Selective Service test.

ACT composite score. The study found that the mean composite score on the American College Test (ACT) could be predicted by (in order of importance) total annual expenditure per pupil from Title I

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* $p < .0001$;

** $p < .01$

ESEA (negative),** percent of teachers holding a master's degree, percent of enrollment from low-income families (negative), percent of population non-white (negative), whether or not the district was a county unit (negative) elementary pupil/teacher ratio, and expenditures per pupil for the operation of plant.

Other things being equal, districts with relatively large numbers of poor families and non-white students tended to have lower predicted composite scores on the ACT. Unexpectedly, it was found that having a relatively large number of students per teacher in the elementary school and having a high per pupil expenditure for the operation of the plant for some reason contributed to higher predicted composite ACT scores. Schools in county unit districts, other things being equal, tended to have lower predicted ACT composite scores.

ACT English scores. The mean score on the English usage portion of the ACT can be predicted in Mississippi school districts by (in order of importance) total annual expenditure per pupil from Title I ESEA (negative),** percent of population non-white (negative),** expenditures per pupil for operation of plant,** elementary pupil/teacher ratio, percent of enrollment from low-income families (negative), average years experience of teachers in the present system, and percent of teachers holding less than a bachelor's degree (negative).

Having a few teachers with less than a bachelor's degree, having relatively many students in elementary classrooms, having relatively

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** $p < .01$

new teachers to the system, and spending relatively large amounts of money for the operation of the plant tended to predict high scores for a district on the English usage portion of the ACT. Districts with relatively large numbers of poor and non-white children tended to have low predicted scores on the ACT English test.

ACT mathematics scores. The variables (in order of importance) total annual expenditure per pupil from Title I ESEA (negative),# percent of teachers holding a master's degree,** whether or not the district is a county unit (negative),** and percent of population non-white (negative) were the predictors of the mean score on the mathematics portion of the ACT. Districts with large numbers of poor and non-white children and county unit districts tended to have low predicted ACT mathematics scores.

ACT social studies scores. The mean score on the social studies portion of the ACT can be predicted by the variables (in order of importance) total annual expenditure per pupil from Title I ESEA (negative), percent of teachers holding a master's degree,** percent of enrollment from low-income families (negative), percent of population non-white (negative),** transportation cost per pupil (negative), expenditures per pupil for teaching supplies, and whether or not a district is a consolidated school district.

** $p < .01$;

# $p < .001$

Similarly to the predictions previously mentioned, districts with large numbers of poor and non-white children and districts with high per pupil transportation costs tended to have low predicted scores on the ACT social studies test. However, consolidated school districts tended to have high predicted scores, other things being equal.

ACT science scores. The variables (in order of importance) total annual expenditure per pupil from Title I ESEA (negative),** percent of enrollment from low-income families (negative),** percent of teachers holding a master's degree, percent of population non-white (negative), and the expenditure per pupil for teaching supplies collectively predicted the mean score on the natural sciences portion of the ACT.

Graduates entering college. The prediction of the percent of the graduates that enter college is a function of the variables (in order of importance) whether or not a district is a municipal separate school district,# percent of teachers holding less than a bachelor's degree (negative),# elementary pupil/teacher ratio, economic index, auxiliary costs per pupil (negative), and average yearly expenditure for secondary school leadership.

Interestingly, variables related to race or poverty were not significant predictors of this measure of quality. Districts with few non-degree teachers, low per pupil auxiliary costs, large

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** $p < .01$;

# $p < .001$;

elementary classes, substantial wealth, and relatively numerous and well-paid secondary principals and instructional supervisors tended to have high proportions of students continuing their formal education. Other things being equal, municipal separate districts tended to have high predicted percentages on this measure.

Dropouts and holding power. No combination of the thirty-four variables included in this study yielded very good predictions of elementary or secondary dropouts or holding power. Several variables were statistically highly significant, but low predictors: per pupil expenditures for instructional salaries and instructional costs; average elementary teachers salary; secondary pupil/teacher ratio; median grade attainment of adults in the community; and average years of experience of teachers. Apparently the accurate prediction of dropouts and holding power depends more on as-yet unidentified variables than on the ones available in this instance. Additional research is needed to identify the important variables related to keeping the students in school.

The mathematical relationships among all these variables are identified in the study and are available upon request to either of these authors. Since they are based on state-wide data, naturally no district fits the prediction pattern exactly.

General Findings

The major finding of the study was a disappointing one, at least for school administrators. Based on state-wide data, several community and socio-economic variables, over which a local school

district has little or no direct control, emerged as statistically highly significant predictors of the quality of education available in the school districts.

Thus, it appeared that, in many instances, no change that the school district can make will necessarily result in a substantially improved educational output until social and economic conditions in the community change. For example, quality education was defined in the study ten different ways. In eight of the ten different ways, the percentage of the population of the school district that was non-white emerged as a major negative predictor of the measure of quality education.

Three socio-economic variables--percent of population non-white, percent of enrollment from low-income families, and annual expenditure per pupil from Title I ESEA--appeared in combination in the prediction of four of the five mean scores of the American College Test (ACT), the study's major measure of academic achievement.

When socio-economic variables were disregarded, several instruction-related variables emerged as somewhat weaker predictors of quality education. The two most prominent ones were the amount of money spent on teaching supplies per pupil and the pupil/teacher ratio in the elementary schools. Oddly, the more pupils per teacher, the higher the predicted quality, other factors being equal.

Among variables related to the staff of the school, the percentage of teachers holding a master's degree was one of the best positive predictors and the average years of experience of the teaching staff was one of the best negative predictors of quality education.

The type of school district organization appeared several times as a predictor of the quality of the school program. Whether or not a district was a municipal separate district was the best single (and a highly significant) predictor of the percent of graduates enrolling in college. Whether or not a district was a consolidated district appeared as a positive predictor of ACT social studies scores, but whether or not a district was a county unit appeared as a negative predictor several times. Contrary to a great deal of previous research, the size of the school district had no significant effect as a predictor of quality.

With a few exceptions, various measures of non-instructional expenditures had little or no relationship to the quality of the school program. The most frequent exception was the per pupil expenditure for the operation of the plant, which appeared several times as a predictor of ACT scores. Transportation costs per pupil and per pupil maintenance costs appeared as predictors in an undesirable direction.

Implications of the Study

Discussion. In simple correlation, just because there is a strong correlation between the heights and weights of a group of children does not imply that height causes weight or that weight causes height. Similarly, in these multiple regression equations it cannot be inferred that being poor or being from a county unit district or having a large number of students per elementary teacher causes anything.

But we know that the growth factors that cause a child to become heavier also usually cause him to become taller (and vice versa). If we know the appropriate relationships and we know a child's weight at age six, then we can predict his height at age 10. We will rarely be completely accurate in these predictions. Many such predictions will be close and some will substantially miss the mark. Similarly, if we know the appropriate relationships and we have a school district's "output" under one set of conditions, then we can predict the school district's "output" under changed conditions.

If, for a six year old child, we set a reasonable objective for his height at age 10, then we also know approximately what the weight should be at age 10 that corresponds with the desired height. By careful attention to the child's diet, body development, etc., we can systematically approach the weight that corresponds with the desired height with some assurance of being at least close to the desired objective. Similarly, if a school district sets a reasonable objective for some educational output, then we can determine approximately what the values of related factors should be for that objective. By careful attention to these related factors, we can systematically approach a set of conditions that correspond to the desired output with some assurance of being at least close to the desired objective.

Specific implications. For example, the relationship among the predictor variables for the mean composite score on the ACT is given by the equation

$$Y' = 14.98475 - 3.42371\,X_1 - 2.14746\,X_2 + .10517\,X_3 + 5.72269\,X_4 + .03640\,X_5 - .01100\,X_6 - .52028\,X_7,$$

where the school district variables are, respectively, percent of population non-white, percent of enrollment from low income families, elementary pupil/teacher ratio, percent of teachers holding a master's degree, per pupil expenditure for operation of plant, per pupil expenditure from Title I ESEA, and whether or not the district is a county unit.

A particular municipal separate school district has a mean composite ACT score of 15.9, close to the predicted mean for that district. Suppose that this district decided that it wanted to raise its predicted mean composite ACT score by about two points. A number of strategies might be employed in an attempt to achieve this objective.

The district has no effective control over the percent of population non-white in the district; therefore, there is little possibility of manipulating this variable to the district's benefit toward the objective. Similarly, in the short run, the district has no way of changing the percent of enrollment from low income families.[1] It would probably be unwise to reduce the expenditure per pupil from Title I ESEA funds. The district is not a county unit district. Therefore, since there is probably no way to manipulate any of these variables, the district should examine what might be done with the remaining variables.

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[1]This district does have a number of children from families of above-average income that do not attend the public schools. A theoretical possibility would be to change the percent by pursuading these families to re-enroll their children in the public schools. However, we will discount this alternative as a feasible short-range objective.

This district has an average of 24.96 children per elementary teacher. If all other factors were held constant, and the number of children per elementary teacher raised to about 44, this could, according to the prediction equation, and for reasons that are not now known, result in approximately the desired increase in the ACT score.

In this district, 17.88% of the teachers hold a master's degree. If all other factors were held constant, and the percent of teachers holding a master's degree were increased to about 53%, then, according to the prediction equation, this could result in approximately the desired increase in the ACT score.

Similarly, if the expenditure per pupil for the operation of the plant were raised from the present $43 to about $98, and all other factors remained constant, approximately the desired score could be reached, according to the prediction equation.

Obviously, some of these manipulations would be more expensive than others, and it would be a simple matter for this district to compute the cost of each and tackle one of the less expensive ones. Some would be easier to accomplish than others, especially over a short period of time.

A more practical approach to attaining an additional two points on the mean composite ACT score might be to manipulate several of these variables simultaneously. A number of combinations could be found within the realm of possibility. One of these would be to increase the number of children per elementary teacher to about 30, and at the same time increase the percent of teachers holding the

master's degree to about 25% and increase the expenditure per pupil for the operation of plant to about $62. According to the prediction formula, this combination of actions could result in approximately the desired increase in the test score, if the other variables in the prediction formula remained constant.

Recommendations

Improving the mean score on the ACT may not be a school district's major concern for educational quality as measured by various types of "output." If not, analyses similar to the one above can be performed with any of the other variables included in this study. In general, though, based on the results of this study, it was recommended that (1) local school officials should not spend massive sums of money on school-related programs without first working actively with governmental and other local agencies to improve the socio-economic conditions that exist in the community; (2) local school officials should spend more money on instructional supplies and equipment; (3) local school districts should hire more master's degree teachers and seek to reduce the number of non-degree teachers; (4) local school districts should re-examine the desirability of low pupil/teacher ratios in the elementary school; (5) the legislature should upgrade both consolidated and county school districts such that they have advantages that are now more available to municipal separate school districts; and (6) a larger percentage of a school district's budget should be spent on instruction, at the expense of non-instructional items, with the exception of operation of plant.